The Rev. Professor Haughton communicated the following Paper on the granites of the province of Leinster.

"The granites of the south-east of Ireland occur in the counties of Dublin, Carlow, Kilkenny, Wicklow, and Wexford, and may be divided physically into two distinct groups.

"1st. The chain of granite hills extending from Booterstown and Dalkey, county of Dublin, in a N. N. E., S. S. W. direction, to Poulmounty, in the south of the county of Carlow, within five miles of New Ross. This granite chain has a length of sixty-eight miles, and a breadth varying from eight to fifteen miles.

"2nd. The series of granite hills, occurring at intervals in the slate of the counties of Wicklow and Wexford, isolated from each other, and rising like islands through the slate. This group of granite hills lies between the main chain and the sea, and appears to be arranged in lines parallel more or less to the axis of the main chain.

"These granite hills are about twenty in number, and extend for a distance of forty-three miles from Ballinaclash, county of Wicklow, to Camaross Hill, county of Wexford.

"Hitherto, so far as I am aware, no decisive proof of difference of geological age has been discovered between these two groups of granites. They are both newer than the Silurian slates, which they penetrate and metamorphose. The following statement, which I have received from Dr. Griffith, to whom I communicated my results, contains the substance of what is known as to the relative geological age of these granites.

"'*Athenæum Club, London,*
"'*12th May*, 1855.

"'DEAR SIR,—In reply to your query relative to the granites of the counties of Wicklow and Wexford, I would observe that in my view the district presents two distinct regions of igneous action, the products of different and probably distant periods.

" ' The first and oldest consists of the well-known granite range which extends in a south-western direction from Dublin Bay, through the counties of Dublin, Wicklow, and Wexford, to Brandon Hill in the county of Kilkenny.

" ' The second presents a more mixed and complicated character, and appears at the surface in the form of numerous elongated detached hills, which also affect a north-eastern and south-western direction, but do not for any great length preserve one direct line; and as in some cases they present at the surface numerous mineralogically distinct rocks, as granite, greenstone, greenstone porphyry, compact feldspar, and endless passages of some of these into each other, consequent on variations in the proportions of their mineral constituents,—it is possible and probable they all belong to the same period of igneous action, which extended over a considerable space, both longitudinally and laterally, in the counties of Wicklow, Wexford, and also Waterford. But, confining my observations for the present to the hills of granite, I may state that detached hills and level tracts composed of that rock occur in three distinct lines to the eastward of the principal granite range.

" ' Starting from the north, the most western commences about three miles north-east of Rathdrum, in the county of Wicklow, and extends in a south-western direction, forming detached ridges of hills, and passing the village of Ballinaclash, terminates to the north of the village of Aughrim. Preserving the same general direction, we next observe granite occurring in Croghan Kinshela Mountain, and extending south-westward to Conna Hill, in the county of Wexford, which may be considered the termination of the most western secondary granite district.

" ' In an eastern direction from the foregoing, detached granite hills occur to the south of the village of Oulart, in the county of Wexford; and in continuation of the same line through about eight miles (Irish) to the south-west, we have the remarkable granite hill of Camaross, situate nearly midway between the towns of Wexford and New Ross. Again, we find granite occupying a considerable tract to the northward and westward of Carnsore Point, on the coast of the barony of Forth, nearly twenty miles to the eastward of the line of Oulart and Camaross.

"'In regard to the constituents of the rock which occurs in the several lines and positions above mentioned, it may be stated that the granite of the western, or principal range, consists of white feldspar, gray quartz, and white, or greenish, or yellowish-white mica, which latter sometimes passes into talcose mica, the prevailing accidental minerals being schorl and common garnet.

"'The granite of the first or most western detached range, that commences north-east of Rathdrum, and terminates at Conna Hill, consists for the most part of constituents similar to those of the great or principal range, viz., white feldspar and white mica, though red feldspar and black mica do occur north of West Acton in Wicklow county. But the constituents of the granite hills, south-west of Oulart, and also of Camaross Hill and that of the Carnsore district, all in Wexford, differ from the former, and consist of red feldspar, gray quartz, black mica, and hornblende. Some time since it occurred to me that possibly these newer granites might be distinguished from the older by the occurrence of potash in the one, and soda in the other; but this is merely surmise, not being aware of any analysis having been made.

"'I am, my dear Sir, faithfully yours,

"'RICHARD GRIFFITH.

"'*Rev. Professor Haughton*,
"'*Trinity College, Dublin.*'

"Such being the state of geological knowledge on this subject, it occurred to me that it might be useful to direct attention to a distinction of a chemical character which appears to exist between these two groups of granites—a distinction to which I have been led in the course of a series of analyses of Irish granites, in which I have been for some time engaged. The distinction to which I have alluded is the following. The granites of the main chain contain more potash than soda, and *vice versâ*, the granites to the east of the chain, which are isolated from it and from each other, contain more soda than potash,—showing that the circumstances, unknown to us, under which the isolated granites were formed, were such as to

yield to the molten mass a quantity of soda greater than that possessed by the granites of the principal chain.

"In illustration of the foregoing generalization, I offer analyses of granites from the following localities:—

GRANITIC CHAIN.

1. Dalkey, county of Dublin.
2. Fox-Rock, county of Dublin.
3. Three-Rock Mountain, county of Dublin.
4. Enniskerry, county of Wicklow.
5. Ballyknocken, county of Wicklow.
6. Kilballyhugh, county of Carlow.
7. Blackstairs, county of Wexford.
8. Ballyleigh, county of Wexford.

ISOLATED GRANITES.

1. Cushbawn, county of Wicklow.
2. Croghan Kinshela, county of Wicklow.
3. Ballymotymore, county of Wexford.
4. Ballynamuddagh, county of Wexford.

"It will be seen, on reference to the Ordnance Map, or any good map of Ireland, that the localities selected extend from the north to the south of both the granite series; and on reference to the Geological Maps of Wicklow and Wexford, it may be observed by those unacquainted with the geological structure of this part of Ireland, that the granites of the second group examined are taken from four distinct and distant isolated patches of granite.

"In order to investigate the relative proportions of quartz, feldspar, and mica, of which these granites were composed, I used the following method, which appears to be as simple as any that has been proposed for such a purpose.

"Let the per-centage of silica in the granite be divided by the atomic weight of silica, and let the quotient be denoted by a.

" Let the per-centages of alumina and peroxide of iron be divided by the atomic weights of alumina and peroxide of iron respectively, and let the sum of the quotients so found be denoted by b.

" Let the per-centages of lime, magnesia, potash, and soda, be divided by the atomic weights of these elements, and the sum of the quotients called c.

" Then, on the hypothesis that the granite is composed exclusively of quartz, feldspar, and mica (margarodite), since

$$\begin{aligned}
&\text{Quartz} &&= \mathrm{Si\,O_3},\\
&\text{Feldspar} &&= \mathrm{RO,\ Si\,O_3 + R_2\,O_3,\ 3\ Si\,O_3},\\
&\text{Margarodite} &&= \mathrm{RO,\ Si\,O_3 + 2\,(R_2\,O_3,\ Si\,O_3) + 2HO};
\end{aligned}$$

we find, if Q, F, M denote the number of atoms of quartz, feldspar, and margarodite present in the granite, the following relations,

$$\begin{aligned}
a &= Q + 4F + 3M,\\
b &= F + 2M,\\
c &= F + M.
\end{aligned} \qquad (1)$$

In these equations, a, b, c are given by the analysis, and from them Q, F, M may be found.

" Having determined Q, F, M, we can obtain the per-centages corresponding to them, by multiplying Q, F, M by their respective atomic weights. The atomic weight of quartz is known, and is 46; but the atomic weights of feldspar and mica vary with the relative proportions of the ingredients composing these minerals. Assuming the average of the analyses of micas from this granite range, already given by me (Proceedings of Royal Irish Academy, vol. VI. part ii.), it is easy to infer from it an atomic weight of mica equal to 305. This atomic weight of mica has been used by me in the calculations made in this Paper, and the per-centages of feldspar found by difference.

" The calculations just mentioned do not prove that the granites to which they are applied are composed of quartz,

feldspar, and mica; as combinations of other minerals might equally well represent the analyses; but on the hypothesis that the granites are composed of these three minerals, they give their per-centages with a close degree of approximation; and further, if the equations cannot be satisfied with positive values of Q, F, M, it may be considered as proved that the granite under consideration cannot be simply a compound of quartz, feldspar, and margarodite.

"It is to be observed, that if a granite be composed of four or more minerals, it is not possible to find by the process just described the per-centages of each mineral, because, in this case, the number of unknown quantities is greater than that of the equations from which they are to be calculated.

"The following Table contains the analyses of eight granites taken from north to south along the principal granite chain, and the notes appended contain a few interesting particulars respecting each granite:—

TABLE I.—*Analyses of Granites from Principal Chain.*

LOCALITIES.	Silica.	Alumina.	Peroxide of Iron.	Lime.	Magnesia.	Potash.	Soda.	Loss by Ignition.	TOTALS.
1. Dalkey, ...	70·38	12·64	3·16	2·84	0·53	5·90	3·13	1·16	99·74
2. Fox-Rock, . .	73·00	13·64	2·44	1·84	0·11	4·21	3·53	1·20	99·97
3. Three-Rock, . .	70·28	16·44	2·60	2·04	Trace	5·79	2·82	—	99·97
4. Enniskerry, . .	74·24	13·64	1·40	1·48	Trace	3·95	2·72	1·20	98·63
5. Ballyknocken, .	70·82	14·08	3·47	2·65	0·31	4·64	2·31	1·39	99·67
6. Kilballyhugh, .	73·24	15·45	1·60	0·99	Trace	4·59	3·08	1·20	100·15
7. Blackstairs, . .	73·20	15·48	1·72	0·96	Trace	4·80	3·18	—	99·34
8. Ballyleigh, . .	73·28	12·64	2·00	1·72	Trace	4·70	2·97	1·04	98·35

"No. 1. *Dalkey.*—Specific gravity, 2·647; a fine-grained granite, containing black and transparent mica. This granite cannot be a ternary compound of quartz, feldspar, and margarodite. This granite was used in the construction of Kingstown Harbour.

"No. 2. *Fox-Rock.*—Specific gravity, 2·638; a coarse granite, which strikes fire under the hammer; it forms a durable and strong building stone, and has been employed in the ring-stones of Trinity College Belfry, and in the construction of the O'Connell Monument at Glasnevin.

"No. 3. *Three-Rock.*—Specific gravity, 2·652; this granite is rather coarse-grained; it was taken from Woodside Quarry, on the slope of the Three-Rock Mountain, and, like No. 2, has been used in the construction of the O'Connell Monument.

"No. 4. *Enniskerry.*—Specific gravity, 2·633; a rather coarse-grained granite, containing veins of black tourmaline.

"No. 5. *Ballyknocken.*—Specific gravity, 2·636; this granite is the best building stone in the neighbourhood of Dublin, and has been extensively used in the public buildings of this city; it forms the principal part of the granite used in the Belfry and Museums of Trinity College. The quarries are situated beyond Blessington, in the county of Wicklow.

"No. 6. *Kilballyhugh.*—Specific gravity, 2·616; this is a fine-grained granite, and works freely; it has been employed in the construction of the chapel of ease in the town of Carlow.

"No. 7. *Blackstairs.*—Specific gravity, 2·622; a medium-grained granite from Kiltealy, on the Wexford slope of Blackstairs.

"No. 8. *Ballyleigh.*—Specific gravity, 2·627; a fine-grained granite, taken from near Poulmounty Bridge, at the south-west extremity of the granite chain.

"Calculating the atomic quotients from Table I., we construct the following Table, containing the values of a, b, c, and of Q, F, M, calculated from equations (1).

TABLE II.—*Atoms of Granitic Minerals.*

LOCALITIES.	Atoms of Silex = *a*.	Atoms of Peroxides = *b*.	Atoms of Protoxides = *c*.	Atoms of Quartz.	Atoms of Feldspar.	Atoms of Mica.
Dalkey, ...	1·530	0·286	0·353	—	—	—
Fox-Rock, ...	1·587	0·296	0·274	0·513	0·252	0·022
Three-Rock, ...	1·528	0·352	0·287	0·445	0·222	0·065
Enniskerry, ...	1·613	0·282	0·225	0·770	0·168	0·057
Ballyknocken, . . .	1·540	0·317	0·283	0·442	0·249	0·034
Kilballyhugh, . . .	1·592	0·321	0·232	0·753	0·143	0·089
Blackstairs, ...	1·587	0·322	0·239	0·714	0·156	0·083
Ballyleigh, ...	1·593	0·271	0·257	0·597	0·243	0·014

"Calculating, by the method already described, the per-centages of quartz, felspar, and mica, contained in the different granites, we find the following:—

TABLE III.—*Per-Centages.*

LOCALITY.	Quartz.	Feldspar.	Mica.
Dalkey, ...	—	—	—
Fox-Rock, . . .	23·60	69·66	6·71
Three-Rock, . .	20·47	59·68	19·82
Enniskerry, . . .	35·42	45·83	17·38
Ballyknocken, . .	20·33	68·97	10·37
Kilballyhugh, . .	34·64	38·37	27·14
Blackstairs, . . .	32·84	41·19	25·31
Ballyleigh, . . .	26·63	67·45	4·27

"From the foregoing calculations it follows, that, with the exception of the Dalkey granite, the granites of the main chain examined might be represented by combinations of quartz, feldspar, and mica, in which the quartz is the most regular mineral, considered with reference to its per-centage.

"The following Table contains analyses of granite belonging to the second group, and supposed to be newer than the others:—

TABLE IV.—*Isolated Granites.*

LOCALITY.	Silica.	Alumina.	Peroxide of Iron.	Lime.	Magnesia.	Potash.	Soda.	Loss by Ignition.	TOTAL.
1. Cushbawn, . . .	70·32	11·24	4·80	3·01	0·73	2·27	3·39	1·62	97·36
2. Croghan Kinshela	80·24	13·24	0·72	0·89	Trace	0·40	5·58	—	101·07
3. Ballymoty, . . .	66·60	13·26	7·32	3·36	1·22	2·31	3·60	2·34	100·01
4. Ballynamuddagh,	68·56	14·44	5·04	3·85	0·43	2·78	3·36	1·00	99·46

"No. 1. *Cushbawn.*—Specific gravity, 2·671; a fine-grained granite, containing hornblende in addition to mica. Besides the constituents given in the Table, the specimen examined by me contained 1·34 per cent. of carbonate of lime.

"No. 2. *Croghan Kinshela.*—Specific gravity, 2·629; this granite is composed of quartz, feldspar, and chlorite. The specimen examined appeared to be composed exclusively of quartz and feldspar. From the great quantity of soda, I infer that the feldspar of Croghan Kinshela is probably albite. On the northern slope of this mountain are situated the old gold streams of Wicklow.

"No. 3. *Ballymotymore.*—Specific gravity, 2·659; a very fine-grained granite, but containing distinctly feldspar, quartz, and black mica.

"No. 4. *Ballynamuddagh.*—Specific gravity, 2·670; a coarse-grained granite, with large plates of black mica.

"Applying to the preceding granites the method of calculation already employed, we find, excluding the granite from Croghan Kinshela, which contains chlorite in place of mica—

TABLE V.—*Atoms of Granitic Minerals.*

LOCALITY.	Atoms of Silex = *a*.	Atoms of Peroxide = *b*.	Atoms of Protoxide = *c*.	Atoms of Quartz.	Atoms of Feldspar.	Atoms of Mica.
Cushbawn, . . .	1·529	0·278	0·300	—	—	—
Ballymoty, . . .	1·448	0·349	0·346	0·067	0·343	0·003
Ballynamuddagh,	1·490	0·344	0·325	0·209	0·306	0·019

"From the foregoing Table it appears, that the granite of Cushbawn cannot be considered as a ternary compound of quartz, feldspar, and margarodite, and in fact it contains a sensible quantity of a mineral which is either hornblende or chlorite. Calculating the per-centages of quartz, feldspar, and mica of the two granites, which may be represented as composed of these minerals, we find—

TABLE VI.—*Per-Centages.*

LOCALITY.	Quartz.	Feldspar.	Mica.
Ballymoty, . . .	3·08	96·02	0·91
Ballynamuddagh,	9·62	84·05	5·79

"Whatever doubt may be attached to the preceding calculations, owing to the hypothesis on which they are of necessity founded, no such doubt or uncertainty can belong to the results of direct experiment, contained in Tables I. and IV., which have a positive value, independent altogether of the inferences which may be deduced from them. From these Tables I deduce the following as the average composition of the granites of the main chain and of the isolated granites:—

TABLE VII.—*Average Composition of Granites.*

	Main Chain.	Isolated.
Silica, ...	72·305	71·430
Alumina, ...	14 251	13·045
Peroxide of Iron, .	2 299	4·470
Lime, ...	1 815	2·778
Magnesia, ...	0·119	0·595
Potash, ...	4·822	1·940
Soda, ...	2·967	3·982
Loss by Ignition, .	0·899	1·240
Total, ...	99·477	99·480

"On examining Tables I. and IV., several interesting differences present themselves in the composition of the two

groups of granites, in addition to the most important difference, to which I have drawn attention, with respect to their alkaline constituents; but I content myself at present with establishing this fundamental distinction between the two groups, and thus furnishing an additional proof of the service which may be rendered to geological science by the more exact and experimental sciences."

Mr. Robert T. Forster, by permission of the Council, read a paper on the molecular formation of crystals: he first gave an account of preceding theories on this subject, and having shown in what respect these different theories failed, he proceeded to explain by what means we can account for the occurrence of secondary forms in general, and also advanced an hypothesis by which the formation of most hemihedral forms can be satisfactorily demonstrated, and the circumstances under which the various changes take place can be clearly pointed out.

"The first writer whom we find deserving of notice is Huygens, who considered the crystals of Iceland spar to be built up of spheroids. He did not, however, give any explanation why these spheroids are so aggregated.

"Hooke, in his 'Micrographia,' advanced a similar hypothesis, except that he considered the atoms to be spherical, a supposition which is utterly inapplicable to the third or rhombohedral system to which he applied it.

"The next writer who commanded attention was M. Prechtl; he considered a fluid to be made up of soft molecules, which, while the body was undergoing its change of state, suffered a change of form, arising from their mutual pressure, and that under different degrees of compressibility different forms were produced. Not only was this hypothesis quite insufficient, but it was also erroneous in a mathematical point of view, as Dr. Wollaston has fully shown.

"Immediately after him Dr. Wollaston published, in 'The